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The earliest settlement of Germany: Is there anything out there?

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ABSTRACT

The German Lower Palaeolithic is well known for its fossil remains of Mauer and Steinheim, and its famous archaeological sites at Bilzingsleben and Schöningen. However, all these sites are dated to a maximum of 600,000 years or much later. While the presence of fossil remains lead to the acceptance of a human occupation of Germany and Central Europe for about 600 ka, earlier indications in form of lithic assemblages are sparse and doubtful. For this paper, evidence was gathered from Early and Middle Pleistocene sites. Seven sites with human fossil remains are described. Archaeological evidence of the Late Early to Early Middle Pleistocene is still sparse: for the time range of 1000–450 ka, altogether seven sites with small and in part questionable artefact assemblages are discussed. Although some of the sites with pebble and flake tool technologies dating after 450 ka are of similar character, there are also well documented sites with large stone and also wooden artefact inventories that have had strong influence on our understandings of hominid behaviour.

1. Introduction

The German Lower Palaeolithic is well known for its famous sites of Mauer (Schoetensack, 1908), Bilzingsleben (Mania et al., 1980) and Schöningen (Thieme, 1999). Yet, all these sites are dated to a maximum of 600,000 years or much later. While the presence of fossil remains lead to the acceptance of a human occupation of Germany and Central Europe for about 600 ka, earlier indications in form of lithic assemblages are sparse and doubtful. Usually found within the gravel deposits of river terraces and mainly collected by amateur archaeologists, such so-called "core tool" assemblages are characterized by several features which distinguishes them from artefacts at confirmed archaeological sites.

The total number of such assemblages is usually small. Among the finds, large worked cores are mainly dominant, whereas flakes and débitage are underrepresented. The few flakes reported have few or no negatives on the ventral side and typically carry cortex on dorsal. These "core tools" often possess heavily abraded edges and ridges and are made of local rocks. The angles of the striking platforms are rather large, between 90° and 100°, and the platform remains show no signs of preparation. Further criticism of their supposed artificial origin is directed at their exclusive presence at lower Pleistocene river terrace deposits, while practically no sites were found in similarly old sandy sediments (Baales et al., 2000) despite a long tradition of intensive and systematic archaeological exploration in Central Europe. Exceptions, at least with regards to the embedding sediments, seem to be the sites Kärlich A and Dorn-Dürkheim 3.

This contribution provides a compilation of the evidence of human presence in Germany in the Early to Middle Pleistocene. At present, human fossil remains found in Germany and dating to the late Middle Pleistocene are labelled as *Homo heidelbergensis*, archaic *Homo sapiens*, pre-Neandertals or early Neandertals based on morphological or chronological grounds. Such differentiation is generally neither consistent with the dating nor with associated techno-complexes. Therefore, all human fossils of Germany dated to the Middle Pleistocene are listed below without consideration of their cultural context. Archaeological sites have been selected for Early to Middle Pleistocene pebble and flake tool technologies without Levallois component. The limitation, however, is arbitrary. To show the smooth transition between Early and Middle Paleolithic technologies, the site of Markkleeberg is added as an example: a workshop for handaxes and Levallois products dating between 250 and 300 ka (Tables 1 and 2).

2. Hominid remains

2.1. Mauer

In 1907, the to-date oldest human fossil of Germany was discovered by workers of a sandpit at the village of Mauer near

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Table 1
Middle Pleistocene fossil remains of *Homo* found in Germany, presumably older than 200 ka.

Site	Location	Assigned species	Skeletal remains	Age	Associated cultural remains	References
Mauer	Sand pit	*Homo heidelbergensis*	Mandible	MIS 13 or 15		Schoetensack, 1908; Wagner et al., 1997; Wagner, 2007
Bilzingsleben	Travertine	*Homo erectus bilzingslebenensis*, pre-Neandertal, late European archaic *Homo sapiens*, or *Homo heidelbergensis*	28 skull fragments, eight teeth, half of a mandible of at least three individuals	MIS 11, 320–412 ka (U/Th series)	X	Vlček, 1978, 1989, 1999a,b; Schwarcz et al., 1988; Vlček et al., 2000, 2002; Mallick, 2000
Steinheim a.d. Murr	Gravel pit	*Homo steinheimensis*, archaic *Homo sapiens*, pre-Neandertal, or *Homo heidelbergensis*	Skull	Late Holstein, 250–300 ka (biostratigraphy)		Berckhemer, 1933; Weinert, 1936; Adam, 1988; Orschiedt, 1996; Prossinger et al., 2003; Czarnetzki et al., 2003b
Bad Canstatt "Haas" quarry	Travertine	*Homo heidelbergensis*, or pre-Neandertal	Crown of a human canine and root of a human molar, or incisor of a cervid?	170–295 ka (U/Th series)	X	Adam, 1986; Adam et al., 1986; Schott, 1989; Czarnetzki, 1999; Czarnetzki and Pusch, 2001
Weimar-Ehringsdorf	Travertine	Early Neandertal	Fragments of four parietals, of a femur, of a mandible, several teeth of at least six individuals	MIS 7, ca. 230 ka (U/Th series)	X	Virchow, 1920; Weidenreich, 1927, 1928; Lindig, 1934; Blackwell and Schwarcz, 1986; Vlček, 1993, 1999a,b; Mallick and Frank, 2002
Reilingen	Gravel Pit	*Homo heidelbergensis*, *Homo erectus reilingensis*, pre-Neandertal	Two parietals and a right temporal	Late Holstein to beginning of Würm, 250–115 ka (biostratigraphy)		Czarnetzki, 1989, 1991; Schott, 1990; Condemi, 1996; Dean et al., 1998; Ziegler and Dean, 1998
Sarstedt	Gravel pit	*Pithecanthropus erectus europaeus*	Left parietal and left temporal	Up to 700,000 years (morphological comparison)		Czarnetzki et al., 2007

Heidelberg (Baden-Württemberg). The find of a human mandible was the fruit of a more than 20 year long systematic search for human traces in the faunal remains of the fluviatile sands of the river Neckar (Schoetensack, 1908). Paleomagnetic examinations of the sediments below and within the find-bearing Mauerer Sande (Mauer sands) show normal polarity (Hambach, 1996). The layers were deposited after the Brunhes/Matuyama boundary and are thus younger than 780 ka. Biostratigraphy places the Mauerer Sande in a younger warm phase of the Cromer complex, either MIS 15 (568–621 ka) or MIS 13 (474–528 ka) (Wagner et al., 1997; Wagner, 2007). The eponymous "Heidelberg" mandible was found complete, but incrusted with sand and gravel. During the preparation process the left P3, P4, M1, and M2 were broken off. Comparing it to Neandertal remains, Otto Schoetensack (1908) identified the fossil as more primitive form and described it as the holotype of a new species, *H. heidelbergensis*, a classification which is still in use (Hardt and Henke, 2007; Mounier et al., 2009), although its validity is debated (Bräuer, 2007). The morphology of the mandible is partly altered by pathological conditions (Czarnetzki et al., 2003a). No cultural context is associated with the human fossil. Even if the artefact character of some pieces of chert from the Mauerer Sande is accepted (Löscher et al., 2007), the majority has been found at different locations of the gravel pit. The artefacts as well as the faunal remains must be regarded as colluvial deposits similar to the human mandible.

2.2. Bilzingsleben

First finds of human fossils from Bilzingsleben (Thuringia) were mentioned by Friedrich von Schlotheim in 1818. The whereabouts of the reported skull and of a molar, which had been discovered in an archaeological horizon above the main layer is, however, unknown. Systematic investigations at the Bilzingsleben site started in 1969 (Mania et al., 1994). Twenty-eight skull fragments and eight teeth of at least two individuals have been discovered at the basis of a travertine sequence. The fragment of a right half of a corpus of a mandible belongs to a third individual. The human fossil remains have been classified by Vlček (1978, 1989, 1999a) and Vlček et al. (2000, 2002) as *Homo erectus bilzingslebenensis* and have morphologically been set apart from the Steinheim skull (see below). Other authors assign the Bilzingsleben fossils to pre-Neandertals or late European archaic *H. sapiens* (Dean et al., 1998) or to *H. heidelbergensis* (Hardt and Henke, 2007). ESR and $^{234}U/^{230}Th$ dates yielded an age of 320–412 ka (Schwarcz et al., 1988), while new U/Th dates suggest an age minimum of 350 ka (Mallick, 2000). An assignment to MIS 11 is discussed (Mania, 1997a,b). For the rich cultural inventory of the site, see below.

2.3. Steinheim a.d. Murr

In 1933, a nearly complete skull was discovered in a gravel pit near Steinheim a.d. Murr (near Stuttgart, Baden-Wurttemberg) (Berckhemer, 1933; Weinert, 1936). The fossil had originally been assigned to *Homo steinheimensis*, and later to archaic *H. sapiens* or pre-Neandertals (Dean et al., 1998), or to *H. heidelbergensis*. The biostratigraphy of the so-called *antiquus* layers, the find-bearing interglacial sands named after associated *Elephas antiquus* remains, is dated into the late Holstein complex with an age of 250–300 ka. No cultural context has been found. The calvarium shows damage on the left side and the skull base, which have been interpreted as evidence of cannibalism (Adam, 1988). Recent examinations, however, ascribe the lesions to pressure caused by the embedding sediment (Orschiedt, 1996). The skull volume has been estimated to 1140 cm^3 through computer tomography (Prossinger et al., 2003). Some features of the inner table of the cranium led Czarnetzki et al. (2003b) to the diagnosis of a menigioma.

2.4. Bad Cannstatt "Haas"

Two tooth fragments from Bad Cannstatt "Haas" quarry (near Stuttgart, Baden-Wurttemberg) are the centre of heated debate. It remains controversial if they are both part of an incisor of a cervid or if they represent the crown of a human canine and the root of a human molar (Adam, 1986; Adam et al., 1986; Schott, 1989;

Table 2
Early to Middle Pleistocene sites with pebble and flake tool technologies and without Levallois component.

Site	Location	Age	Stone artefacts	Bone/antler artefacts	Wooden artefacts	Associated hominin remains	Associated faunal remains	References
100–700 ka								
Dorn-Dürkheim 3	Sand and clay conglomerats	Lower Pleistocene, Matuyama stage (palaeomagnetism)	Three core and flake tools?				X	Fiedler and Franzen, 2002
Kärlich A	Clay quarry	Jaramillo event, OIS 23	Few potential artefacts, one pebble tool and a core				X	Bosinski et al., 1980; Würges, 1984, 1986; Bosinski, 1992; Roebroeks and van Kolfschoten, 1995; Baales et al., 2000
Kärlich B	Clay quarry	Above Brunhes/Matuyama boundary	Few cores and flakes?					Bosinski et al., 1980; Würges, 1986; Gaudzinski et al., 1996
700–450 ka								
Kärlich H	Clay quarry	MIS 12 (biostratigraphy), max. 618 ky ± 13 ky (^{40}Ar/^{39}Ar, underlying tephra layer), min. 452 ky ± 8 ky (^{40}Ar/^{39}Ar, overlying tephra)	26 pebble tools, cores and flakes				X	Würges, 1984; Kröger et al., 1988; Bosinski, 1992
Miesenheim I	Clay quarry	MIS 13 (biostratigraphy) min. 452 ky ± 8 ky (^{40}Ar/^{39}Ar, overlying tephra)	Five flakes				X	Turner, 1989; Bosinski, 1992; van Kolfschoten and Turner, 1996
Winningen	Gravel beds	Max. 600 ka (formation of gravel deposits), probably long term accumulation	Few choppers, chopping tools, cores, flakes, two proto-handaxes					Berg and Fiedler, 1983
Attenfeld	Clay quarry	450–500 ka (Pedological analysis), or Middle Palaeolithic? (morphology)	Handaxe, few cores and flakes					Bleich, 1990; Rieder, 1990; Jerz et al., 1993
Younger than 450 ka								
Kärlich "Seeufer"	Clay quarry	Min. 400 ka (^{40}Ar/^{39}Ar), or 300–275 ka (tephrostratigraphy, biostratigraphy: Kärlich-Interglacial, MIS 11 or 9)	ca. 200 artefacts including one unifacial handaxe	X	X			Bosinski et al., 1980; Kröger et al., 1988; Gaudzinski et al., 1996
Ariendorf 1	Clay quarry	Max. 415 ka (^{40}Ar/^{39}Ar), cooler phase of the Ariendorf-/Holstein- Interglacial (biostratigraphy)	120 artefacts including a scraper				X	Bosinski et al., 1993; Turner, 1997
Ariendorf 2	Clay quarry	Early Saale (geostratigraphy, biostratigraphy)	37 artefacts (mainly flakes)	X?			X	Bosinski et al., 1993; Turner, 1997
Ariendorf 3	Clay quarry	215 ± 6 ka (^{40}Ar/^{39}Ar)	Few artefacts				X	Turner, 1997
Kartstein	Travertine	250 ± 50 ka (^{234}U/^{230}Th), MIS 9	Few choppers, chopping tools?				X	Löhr, 1978; Brunnacker et al., 1982; Bosinski, 1992
Rheindahlen D1	Clay quarry	Underneath Middle-Palaeolithic layers	Two pebble tools					Thissen, 2006
Rheindahlen C1	Clay quarry	Underneath Middle-Palaeolithic layers	One pebble tool and two flakes					Thissen, 2006
Bad Cannstatt, "Haas", "Lauster" quarries	Travertine	145–295 ka (ESR- and Th/U-dates), MIS 7, or ca. 400 ka, MIS 11	More than 3000 artefacts with marked small tool component	X?	X	X?	X	Wagner, 1984; Bosinski, 1994; Wagner, 1995; Schatz, 2003; Müller-Beck, 2006; Keefer, 1993
Schöningen 12	Lignite mining fields	Reinsdorf Interglacial, MIS 11 (biostratigraphy)	Stone artefacts with marked small tool component		X		X	Thieme and Mania, 1993; Thieme et al., 1993; van Kolfschoten, 1995; Thieme, 1999, 2007
Schöningen 13 I	Lignite mining fields	Min. 400 ka (TL dates on flint)	Stone artefacts with marked small tool component				X	Thieme and Mania, 1993; Thieme et al., 1993; Richter, 1998; Thieme, 2007
Schöningen 13 II-4	Lignite mining fields	Late Reinsdorf Interglacial, MIS 11 (biostratigraphy), or OIS 9d	More than 1200 stone with marked small tool component		X		X	Thieme and Mania, 1993; Thieme et al., 1993; Urban, 1996; Thieme, 1996, 1997, 1999, 2007; Jöris and Baales, 2003
Bilzingsleben	Travertine	420–350 ka, OIS 11, or 250–200 ka, OIS 9/7	Stone artefacts with marked small tool component	X	X	X	X	Burdukiewicz et al., 1979; Mania, 1979; Mania et al., 1980; Mai et al., 1983; Mania and Weber, 1986; Mania and Mania, 1988a,b; Weber, 1989; Davidson, 1990; Bednarik, 1993; Mania, 1997a,b; Eissmann, 1997; Gaudzinski, 1998; Steguweit, 1999, 2003; Mania and Mai, 2001; Becker, 2003; Beck et al., 2007

(*continued on next page*)

Table 2 (*continued*)

Site	Location	Age	Stone artefacts	Bone/antler artefacts	Wooden artefacts	Associated hominin remains	Associated faunal remains	References
Memleben	Gravel pit	Bilzingsleben I Interglacial	Stone artefacts with marked small tool component				X	Weber, 1980; Mania, 1984, 1993; Mania and Mania, 2008
Wangen	Gravel pit	Bilzingsleben I Interglacial	Stone artefacts with marked small tool component				X	Weber, 1980; Mania, 1984, 1993; Mania and Mania, 2008
Wallendorf	Gravel pit	Bilzingsleben II Interglacial; MIS 9 (biostratigraphy)	ca. 1000 artefacts with marked small tool component				X	Töpfer, 1968; Mania, 1984; Bosinski, 1994; Mania and Mania, 2008
(Markkleeberg)	Gravel pit	250–300 ka, early Saale glaciations, MIS 8 (geostratigraphy)	More than 5000 artefacts, handaxes, Levallois products					Jakob and Gäbert, 1914; Grahmann, 1955; Mania and Baumann, 1980, 1981; Mania, 1983a,b,c; Baumann et al., 1983; Schäfer et al., 2003, 2004

Czarnetzki, 1999; Czarnetzki and Pusch, 2001). An U/Th dating of the travertine in which they were discovered in 1981 yielded an age of 170–295 ka. The tooth fragments which – similar to the Steinheim skull – might be assigned to *H. heidelbergensis* or to the group of pre-Neandertals, is part of a rich archaeological assemblage (see below).

2.5. Weimar-Ehringsdorf

Since 1908, the travertine quarries of Weimar-Ehringsdorf (Thuringia) have yielded cranial and postcranial remains (fragments of four parietals, of a femur, and of a mandible, several teeth) of at least six individuals (Virchow, 1920; Lindig, 1934; Vlček, 1993, 1999a,b) including a child represented by fragments of a mandible, the thorax and an arm. Most well-known is a fragmentary calvarium that probably belongs to a female (Weidenreich, 1927, 1928). The fossils had been incrusted in the matrix of the so-called lower travertine. Its dating is still controversial (Schäfer, 1991). U-series analysis resulted in an age of ca. 230 ka for the find-bearing layer, correlating with MIS 7 (Blackwell and Schwarcz, 1986). This age has recently been confirmed by U-series analyses of travertine micro-samples (Mallick and Frank, 2002) that delivered average dates of 243 ± 6.2 ka for the lower travertine. The human fossil remains have generally been assigned to early Neandertals (Dean et al., 1998). The archaeological assemblage associated with the human fossils will not be described in detail in this article due to its Middle Palaeolithic character (Schäfer, 1991).

2.6. Reilingen

In 1978, two parietals and a right temporal bone that fit together have been discovered in the Rhine valley at Reilingen near Heidelberg (Baden-Wurttemberg). The fossil remains were brought up by dredging in a waterlogged gravelpit. The stratigraphic position of the skull fragments is thus unclear. Based on biostratigraphic criteria, the age ranges from late Holsteinian to the beginning of the Würmian glaciation with a maximum age of 250 ka and a minimum age of 115 ka (Ziegler and Dean, 1998). Although similar or even younger in age, the Reilingen fossil is generally seen as more archaic than the Weimar-Ehringsdorf human remains and has been assigned to *H. heidelbergensis*, *Homo erectus reilingensis* or the pre-Neandertal group (Czarnetzki, 1989, 1991; Schott, 1990; Condemi, 1996; Dean et al., 1998). No cultural context has been found.

2.7. Sarstedt

In 2002 and 2004, fragments of a left Os parietale (Sst IV) and a nearly complete left temporal bone (Sst V) were identified within an assemblage of faunal remains from a waterlogged gravel pit near Sarstedt (Lower Saxony). The age of the human fossils has been estimated to 700,000 years or even older on the basis of morphological comparisons with Dmanisi 3444 and Sangiran 2. Czarnetzki et al. (2007) assigned the skull fragments to *Pithecanthropus erectus europaeus*. There is no cultural context clearly associated with the human remains.

3. Archaeological sites dated to 1,000,000–700,000 a (Fig. 1)

3.1. Dorn-Dürkheim 3

The site was discovered in 1989 and excavated during the following decade. Beside the known Upper Micocene faunal site Dorn-Dürkheim 1, three supposed artefacts, a core tool, labelled as polyeder, a flake with scraper retouch, both made of quartzite, and a small quartz cortex flake named as “borer-like” have been found

Fig. 1. Lower Palaeolithic sites in Germany older than 450 ka.

within a lower Pleistocene deposit of conglomerates, sands and clay, associated with numerous animal bones and teeth underneath a sandy deposit with inverse palaeomagnetism and dated into the Matuyama stage (Fiedler and Franzen, 2002). Although the authors presented a detailed study of the reduction sequence of the polyeder as well as the scraper, their artefact character is not very convincing, and the intention of the retouches questionable. The presence of numerous but relatively small and irregular negatives on the so-called polyeder has been used as an argument for its artificial origin. However, comparative studies of natural fracture patterns on river banks have demonstrated the frequent natural occurrence of even bifacially flaked "chopping tools" in riverine sediments (Albrecht and Moser, 1996).

3.2. Kärlich A and B

A number of lower palaeolithic artefacts were retrieved in several surveys and excavation at the clay quarry of Kärlich near Koblenz since 1980 (Bosinski et al., 1980). Kärlich is a major site for Quaternary research in Germany with one of the most complete geo- and biostratigraphic records of the region. Several archaeological assemblages have been reported from this site. Some potential artefacts were discovered at the bottom of the Quaternary deposits (Layer A) within a gully filled with sand/clay deposits that cuts into a Tertiary loam. Only two artefacts have been considered as certain and published by their finder (Würges, 1984, 1986); a pebble tool and a core from the upper part of Layer A directly underneath a deposit of Rhine River gravels (Layer Ba). The artefacts have been associated with teeth fragments of *Hippopotamus* found in similar gullies. The site, labelled as Kärlich A, has been dated into the Jaramillo event (MIS 23) and is seen as the earliest indication of a human presence in Germany from a stratified context (Würges, 1984, 1986; Bosinski, 1992). However, the morphology of the artefacts appears very simple, and their artificial character as well as their stratigraphic context has been questioned by other authors (Roebroeks and van Kolfschoten, 1995; Baales et al., 2000).

In Layer Bb of the same profile, a small assemblage of abraded and slightly rounded flakes and cores made of quartzite appeared in a stratigraphic position just above the Brunhes/Matuyama boundary (Bosinski et al., 1980; Würges, 1986). These objects are not clearly distinguished from naturally fractured rocks (Gaudzinski et al., 1996).

4. Sites between 700,000 and 450,000 a

4.1. Kärlich H

Of a more certain artificial character is the assemblage of Kärlich Layer H, where a rescue excavation during the ongoing quarrying activity recovered 26 artefacts made of quartz and quartzite from a remaining area of only 1 m^2 (Würges, 1984). Artefacts and the faunal remains, including the tusk and femur of steppe mammoth (*Mammuthus trogontherii*) belong to a colder stage which Bosinski equated with MIS 12 (Bosinski, 1992). In addition to unifacially and bifacially worked pebbles, the assemblage contains two cores and a number of flakes, one of them appearing as a "pièce esquillée". Its chronostratigraphic position within the Kärlich profile is above a tephra layer with an $^{40}Ar/^{39}Ar$ date of 618 ka ± 13 ka, and an

Fig. 2. Lower Palaeolithic sites in Germany younger than 450 ka.

overlying pyroclastic deposit revealed an age of 452 ka ± 8 ka (Kröger et al., 1988).

4.2. Miesenheim I

Located west of the Kärlich quarry is the site Miesenheim I, situated on the east bank of the Nette River, a tributary of the Rhine. A small assemblage of five quartz and quartzite flakes was found *in situ* and associated with a temperate fauna, while the pollen spectrum points to the end of a warm phase. Comparisons have been made to the above-mentioned Kärlich-Interglacial (Turner, 1989; van Kolfschoten and Turner, 1996), and overlying tephra deposits have been identified as the same tephra found at Kärlich Layer H and dated to 452 ka ± 8 ka. Bosinski's classification into MIS 13 suggests, however, a somewhat older age than the geostratigraphically similarly positioned Kärlich H (Bosinski, 1992).

4.3. Winningen

Potentially of a similarly old age is a small assemblage consisting of several choppers and chopping tools, cores, larger flakes and two proto-handaxes found in the gravel beds of the lower Mosel river terrace at Winningen (formerly Koblenz-Bisholder) south of Kärlich. The age of the gravel deposit formation is approximately 600 ka, and marks the maximum possible age of the artefacts. Similarities are seen with the assemblage of Kärlich-Seeufer (Berg and Fiedler, 1983). However, based on the different preservation condition, the excavators assume that it is not a homogeneous assemblage but it is rather possible that the artefacts have accumulated over a certain period of time.

4.4. Attenfeld

In the southeastern part of Germany, today Bavaria, the clay quarry of Attenfeld remains at present the only lower Palaeolithic site in that area. Jan Weinig found, during clearing of the 8 m thick loess deposits at the base in 1989, a quartzite handaxe in the lowest horizon, a gravel bed containing numerous fossilized wood fragments that separates the Pleistocene loess sequence from the subjacent Tertiary sediments (Bleich, 1990). In a successive excavation of the Institute of Early Prehistory, University of Tübingen under the direction of H. Müller-Beck, several flakes and cores were found (Rieder, 1990). Pedological analysis positions Attenfeld in the beginning of the Mindel glacial, c. 450–500 ka BP (Jerz et al., 1993). This early age, however, is questioned since the morphological analysis of the artefacts points towards a Middle Palaeolithic origin (Müller-Beck, personal communication).

5. Sites younger than 450,000 a (Fig. 2)

5.1. Kärlich "Seeufer"

Directly overlying Kärlich H is the so-called "Seeufer" site where approximately 100 artefacts were unearthed in 1980 (Bosinski et al., 1980; Kröger et al., 1988; Gaudzinski et al., 1996). The site's name (meaning "lakeshore") refers to the association of the assemblage with lacustrine sediments and floral remains (Layer Ja) belonging into the "Kärlich-Interglacial". Whether the Kärlich-Interglacial correlates with MIS 11 (Kröger et al., 1988), or is of a younger age, presumably MIS 9 (Gaudzinski et al., 1996), is under debate. The Kärlich-Interglacial is a warmer stadium characterized

through palynological studies as a pre-Eemian climatic optimum dominated by oak and hazel pollen and accompanied by thermophile taxa like *Hedera*, *Vviscum*, *Buxus*, *Vitis*, *Ligustrum* and *Azolla filiculoides*. The faunal remains included *Palaeoloxodon antiquus*, *Rhinoceros* sp., *Equus* sp. and *Carnivora* sp. A correlation of the Kärlich-Interglacial with the Holstein interglacial has been rejected by Gaudzinski et al. (1996) based on the different palynological records.

The artefacts of Kärlich-Seeufer are made of quartz and quartzite. Simple flakes and choppers are dominant. They do not give any hints towards a preparation of the cores. Only one core with a striking platform preparation and bipolar reduction was observed. The most intriguing artefact is, however, a large unifacial tool with pointed shape, which Bosinski identified as a handaxe and highlighted as unique among the lower Palaeolithic assemblages of Central Europe (Bosinski, 1992). Field research resumed in 1987, and ~100 artefacts were retrieved, including a number of worked wood, bone and antler artefacts. Based on a series of $^{40}Ar/^{39}Ar$-dates a minimum age of Kärlich-Seeufer of ~400 ka has been postulated by Kröger et al. (1988). However, tephro-biostratigraphical data point to a significantly younger age of 300–275 ka.

5.2. Ariendorf

Another Pleistocene profile of the middle Rhine valley with evidence for human occupation around 400 ka is known from Ariendorf, northwest of Kärlich. There, a soil layer of the so-called Ariendorf-Interglacial very likely correlates with the Kärlich-Interglacial (Bogaard, in Kröger et al., 1988), Holstein-Interglacial and MIS 11 (Bosinski et al., 1993; Turner, 1997). Three archaeological layers have been discovered in the profile. They are embedded in loess deposits and between $^{40}Ar/^{39}Ar$-dated volcanic ashes from approximately 410 ka to 215 ka BP. Located just above a Holstein paleosol, Ariendorf 1 is associated with a typical glacial megafauna including mammoth, wooly rhinoceros, horse and wolf, as well as lemming (*Lemmus lemmus* and *Dicrostonyx* sp.) and probably belongs to a colder phase of the Ariendorf-/Holstein-Interglacial. Around 120 artefacts were identified, made of quartz, quartzite and siliceous slate. Except a scraper made of flint, no formal tools were part of the assemblage. However, refitting analysis showed that tool production happened on-site. Ariendorf 2 is positioned in the early Saale glacial and displays a similar cold-climate fauna as Ariendorf 1 with remains of mammoth, woolly rhinoceros, horse and megaceros. However, the fauna of Ariendorf 2 also includes bones and antler fragments of red deer (*Cervus elaphus*) which is usually associated with moderate climate conditions. It is separated from Ariendorf 1 by a palaeosol probably representing the final Holstein-Interglacial. Bosinski et al. (1993) reported the discovery of a circular housing structure perhaps using the hole of a fallen tree and with an artificially levelled floor. A concentration of mammoth and rhinoceros ribs was interpreted as framework for a roof, indicating that the structure was not dismantled when the place was abandoned (Bosinski et al., 1993: 161). Only 37 artefacts made of locally available quartz, quartzite and siliceous slate were retrieved, almost all simple and unmodified flakes. Four flakes could be refitted, interestingly, one refitting was made on a flake found within the circular structure and a flake found outside. An antler fragment showing traces of abrasion was probably used as hammer. The cultural sequence of Ariendorf ends to the hanging with Ariendorf 3, a small assemblage of few lithic artefacts and a fauna similar to Ariendorf 1 and 2, found in a humic horizon of the late Saale glacial, $^{40}Ar/^{39}Ar$-dated to 215 ± 6 ka (Turner, 1997).

5.3. Kartstein

Embedded in a solid travertine formation ("Kartstein-Travertin") are several choppers and chopping tools and animal bones at the Kartstein cave in the Eifel region (Löhr, 1978; Brunnacker et al., 1982). $^{234}U/^{230}Th$-dates of 250 ± 50 ka suggest its formation during MIS 9. The few artefacts were embedded in the solid and hard travertine and had to be recovered "en bloc", and then chemically separated from the travertine using a 10% HCl solution. The artefact character of these finds as displayed in Brunnacker et al. (1982: 201ff) is not very convincing, especially considering their relatively young age. Also, the absence of flake tools in this assemblage can be seen as an argument for natural formation. The solid travertine prevented further investigations (Bosinski, 1992).

5.4. Rheindahlen D1 and C1

Following the Rhine River further north, the Rheindahlen site delivered the only presently known evidence for human occupation during the Lower Palaeolithic of the lower Rhine valley. The site is within a large loess deposit that was quarried for the production of bricks. Its loess stratigraphy of approximately 10 m at present has been the target of extensive archaeological investigations as well as bio- and geochronological studies since the 1930s. Rheindahlen represents a more or less continuous chronology of the past 850 ka, to MIS 21 (Thissen, 2006). Best known for its large artefact deposits of several Middle Palaeolithic settlements containing six cultural layers with Late Acheulean and Micoquien assemblages, few stone tools were found underneath the middle Palaeolithic. Two worked pebbles of a non-local quartz appeared in the lowest cultural layer (D1). Just above, a slightly worked pebble and two flakes with few modifications all made of quartz were found within layer C1. The morphology of these findings is rather simple: however, their artificial character can be considered as certain due to the use of non-local raw materials.

5.5. Bad Cannstatt "Haas", "Lauster"

Besides the classic hominin sites of Mauer, Steinheim and Reilingen along the Neckar River, Stuttgart Bad-Cannstatt marks the southernmost spot of lower Palaeolithic activities in western Germany. Two travertine quarries ("Haas" and "Lauster") were subject of an intensive and long-term research project since 1980, headed by the State Department of Archaeology (Landesdenkmalamt) of Baden-Württemberg under the direction of Eberhard Wagner (Wagner, 1984). The remarkably large amounts of organic materials, faunal and floral remains, made Bad Cannstatt an important site for the paleo-ecological reconstruction of this region during the upper Middle Pleistocene. A series of ESR- and Th/U-dates showed a large chronological variation between 145 ka and 295 ka. The stratigraphic position of the Haas–Lauster complex is underneath two glacial loess formations which represent the Riss and Wurm glaciations. A stratigraphic correlation with MIS 7 has been suggested by Bosinski (1994). Newer finds and radiometric dates from the adjacent quarry "Bunker", however, place Bad Cannstatt in the Holstein-Interglacial (MIS 11), approximately 400 ka (Wagner, 1995; Schatz, 2003; Müller-Beck, 2006).

Numerous organic materials had been embedded in the travertine layers and preserved, including the remains of several elephants. The presence of *Dicerorhinus hemitoechus*, *E. antiquus*, the European pond turtle and the leaves and fruits of *Buxus sempervirens* indicate a warm, Mediterranean environment. Animal bones, working tools and cut- and breakmarks on the skeletal remains were found in a closed context as were artefacts made of wood, including the fragment of a lance (Keefer, 1993). Bad

Cannstatt has been interpreted as a hunting or "kill" site besides a lake or a pond that was formed by hot mineral springs active during warmer periods. The artefact material is in general made of Mesozoic chert ("Hornstein") and dominated by smaller, almost microlithic flakes and tool forms. Various forms of "micro choppers", chopping tools, scrapers and proto-handaxes characterize the assemblages of Cannstatt. The microlithic component in Bad Cannstatt seems rather unusual: however it can be related to similar assemblages from Bilzingsleben (Mania et al., 1980) and Vértesszöllos in Hungary (Kretzoi and Vertés, 1965). A supposed bone tool made of the tibia of an elephant was found and interpreted as a hoe-like tool (Wagner, 1995: 263). The presence of hominids is probably further indicated by two teeth fragments of a molar and a lower left canine.

5.6. Schöningen 12, 13 I, and 13 II-4

Further north in the lowlands of Lower Saxonia and Saxonia Anhaltine are large open-cast lignite mining fields. Massive Pleistocene loess deposits that formed the present landscape cover the lignite beds. Large rotary excavators carve into the loess exposing countless archaeological finds and sites from the Medieval Age to the Lower Palaeolithic. The quarrying is accompanied by archaeological surveys all year round.

Directed by Hartmut Thieme, archaeological surveys and rescue excavations within the lignite mining field Schöningen are ongoing since 1983 (Thieme and Mania, 1993; Thieme et al., 1993; Thieme, 2007). Several lower Palaeolithic sites are located in Middle Pleistocene layers at a depth of 10–15 m below the present surface; the most important ones are listed below.

Schöningen 13-I is located within sandy lakeshore sediments on the basis of an interglacial stratigraphy, presumably Holsteinian. The well preserved faunal remains include *M. trogontherii*, bovinae, horse and red deer. Associated are small flakes and tools made of flint. Burnt flint material yielded a TL date of more than 400 ka (Richter, 1998).

Schöningen 12 is positioned in the climatic optimum of the Reinsdorf Interglacial (Thieme and Mania, 1993; Thieme et al., 1993). Faunal and botanical remains confirmed its Mediterranean character, and it presumably is correlated with MIS 11. Its lakeshore sediments preserved numerous macrobotanical remains and a *Palaeoloxodon antiquus* fauna with *Stephanorhinus kirchbergensis*, *Equus mosbachensis*, *C. elaphus*, *Ursus* sp., *Bovidae*, *Capreolus capreolus*, wild boar and lion. The microfauna includes *Castor fiber*, *Lemmus lemmus*, *Clethriomys glareolus, Arvicola terrestris*, *Arvicola terrestris cantiana*, *Microtus oeconomus* and *Trogontherium cuvieri* (van Kolfschoten, 1995). Among the stone tools are denticulated pieces, pointed forms, sinuate pieces which can be compared to the lithic inventory of Bilzingsleben (Thieme, 1999, 456–458). Four potential wooden artefacts, fragments of *Abies alba* (Thieme, 1999) with notches on one or both ends, have been interpreted as clamp shafts. Deliberately broken bones and bones with cutmarks gave evidence for the processing of the killed prey at the site.

The most outstanding discovery at Schöningen was a hunting camp and kill site found at the site 13 II-4 with the remains of more than 20 horses on a former lake shore. Associated with the slaughtered horses were six excellently preserved wooden spears and fragments of two others (Thieme, 1996, 1997, 1999). The stone artefact inventory was exclusively made of flint and is mainly composed of carefully retouched types of scrapers and different types of points. Evidence for an on-site blank production is lacking, but more than 1200 small flakes, debris from the retouching process as well as bone retouchers provide evidence for a local maintenance of brought-in stone tools. Schöningen 13 II-4 was originally dated into the late Reinsdorf Interglacial with pine–spruce–larch–birch-forests following the analyses of pollen and molluscs (Urban, 1996). The faunal remains represent mainly *Equus mosbachensis*, bison, ass, and red deer. However, a dissenting view about the age of Schöningen has been presented by Jöris and Baales (2003). Based on the correlation of the Quaternary stratigraphy of Schöningen with MIS-chronology, they revised the chronological position of the Rheinsdorf Interglacial to MIS 9e and positioned Schöningen 13 II-4 into the transitional phase towards MIS 9d. The associated Schöningen spears would have, therefore, an age of approximately 310 ka, about 100 ka younger than originally stated.

5.7. Bilzingsleben

Encompassed by the central German uplands of the Hercynian and Thuringian Forest and the Elbe-Saale river system is the eastern region of lower Palaeolithic sites, with Bilzingsleben being the most important one.

Discovered by Dietrich Mania in 1969 and investigated since, Bilzingsleben has the richest account of human presence of all German lower Palaeolithic sites so far (Mania, 1997a,b). The settlement is located at the base of a travertine deposit that was formed during a middle-Pleistocene interglacial between the Elster and Saale glaciations (Mania et al., 1980). It is situated on the shore of a former lake that was damned by the travertine barrier. Imprints of thermophilous plants and high amounts of well preserved faunal remains attest the warm climatic conditions during its occupation (Mai et al., 1983). Numerous bones from rhinoceros (*Dicerorhinus kirchbergensis* and *Dicerorhinus hemitoechus*) as well as *P. antiquus*, *Bison priscus*, *Bos primigenius*, *C. elaphus*, *Dama* sp., *Capreolus capreolus*, *Sus serola*, *Equus mosbachensis*, *Equus taubachensis* and *Ursus deningeri-spelaeus* are associated with a rich molluscs and micro vertebrae fauna. The reconstructed landscape has been labelled as a forest steppe with a Mediterranean flora. The dates for Bilzingsleben vary between 420 and 350 ka, correlating with MIS 11 (Mania and Mai, 2001); and only 250–200 ka, respectively MIS 9 and 7 (Eissmann, 1997, 2002).

Various settlement features have been unearthed at Bilzingsleben. Among them are three round and oval structures with hearths which have been interpreted as hut-like shelters and an oval-shaped stone plaster made of pebbles of a non-local rock (Mania and Weber, 1986). High amounts of artefacts, lithic materials as well as bone and antler tools were found. Among the lithic artefacts are mainly small flakes made of flint with denticulated and serrated edges, side and end scrapers, pics and borers. Core tools are made of quartzite, limestone and igneous rocks (Burdukiewicz et al., 1979; Mania and Weber, 1986). The appearance of a supposed "microlithic tradition" in the central European Lower Palaeolithic (Valoch, 1977) is, however, at least for Bilzingsleben clearly connected with the available raw material rather than an independent technocomplex (Weber, 1989). A number of chisel-like tools, scrapers and supports are made of bone. Tools made out of deer antler have been interpreted for hoe-like function (Mania, 1979). A number of cutmarks appearing on several bones were not associated with tool functions but have been interpreted as intentional engravings and possibly earliest *objets d'art* (Mania and Mania, 1998a; Bednarik, 1993; Steguweit, 1999). Furthermore, the processing of wood was observed (Mania and Mania, 1998a, b). However, the role of Bilzingsleben as a significant lower Palaeolithic site has been challenged by various authors (e.g. Davidson, 1990; Gaudzinski, 1998; Becker, 2003; Steguweit, 2003), and most recently by Beck et al. (2007). In their excavations at the Bilzingsleben in 2004, Beck et al. could not find any evidence for the presence of living floors and camp structures. They concluded that the Bilzingsleben site is a product of a complex taphonomy and argue that

gravitational mass flow accumulated the organic and lithic materials instead of human interaction. The lithic assemblage is seen as a product of various natural forces like water transport and thermal alteration caused by frost. However, their argument that the still significant number of uncontested stone tools and bones with cutmarks found at Bilzingsleben are rather normal components of the Middle Pleistocene hunter-gatherer landscape were incorporated in the mass flow is purely hypothetical and does not appear very convincing.

5.8. Memleben, Wangen, Wallendorf

The sites of Memleben, Wangen and Wallendorf delivered artefact assemblages smaller in size but similar to the Bilzingsleben complex. The Memleben and Wangen assemblages contain mainly smaller flakes, sometimes with denticulated and notched retouched edges, and several cores (Weber, 1980; Mania, 1984, 1993). The occurrence of *P. antiquus* and *Dicerorhinus kirchbergensis* as well as water molluscs in the fluviatile sediments of the archaeological layer indicates a warm phase that Mania correlates with the oldest interglacial of Bilzingsleben I (Bosinski, 1994; Mania and Mania, 2008). At Wallendorf, approximately 1000 artefacts were collected in a gravel pit during surveys accompanying the ongoing mining. The assemblage is similar to Bilzingsleben, although the microlithic component is less obvious due to the different method of recovery (Töpfer, 1968; Bosinski, 1994). Around three-quarters of all artefacts are unmodified flakes. Among the remaining finds are several retouched forms like scrapers, denticulates and notched pieces, proto-handaxes and several cores. The presence of several blade-like flakes and prepared cores gives Wallendorf a rather "modern" component. Based on their morphology, it has been suggested that they represent flintknapping workshops (Mania, 1984). Wallendorf belongs probably into a later warm phase before the Saale glaciation (MIS 9), or the Bilzingleben II interglacial, respectively (Mania and Mania, 2008). Analysis of molluscs suggested a cool-moderate climate, but still suitable for *P. antiquus* whose remains were found at Wallendorf.

5.9. Markkleeberg

Markkleeberg in the Pleisse valley south of Leipzig was discovered in 1895 by the geologist Franz Etzold. Systematic surveys in the gravel pits were conducted by Jakob and Gäbert in the early 20th century. Gäbert recognized the ground moraine of the second last Saale glaciation directly above the archaeological horizon, which led to an initial date of over 130 ka (Jakob and Gäbert, 1914). Research commenced at the gravel pit of Markkleeberg in the 1950s and confirmed the geostratigraphic position of the rich archaeological site that had yielded ca. 3000 artefacts by that time (Grahmann, 1955). The site was again visited and excavated by the end of the 1970s due to ongoing extensive lignite mining in the area that eventually reached and threatened the gravel deposits. The excavations conducted by Baumann and Mania (Mania and Baumann, 1980, 1981; Mania, 1983a, b, c; Baumann et al., 1983) brought up about 4500 artefacts. Some 90 handaxes in various production stages were part of the assemblage: however, only 5 of them seemed finished. The majority of the artefacts were flakes (80%), produced from Levallois cores. Also, blades and prepared blade cores appeared. Based on the high amounts of debitage, unfinished products and pieces with structural flaws and accidental breaks Markkleeberg has been interpreted as a frequently visited raw material source and flintknapping workshop where mainly the assaying of flint pebbles and initial preparation into cores and core tool preforms were carried out. Most of the prepared and usable material was then brought away. Recent excavations took place in the quarry Espenhain in 2000–2001 following reclamation measures after the lignite mining had ended (Schäfer et al., 2003). In total, 300 m^2 were investigated and delivered another 577 artefacts, mainly parts of the chaîne opératoire of Levallois production, as well as numerous faunal remains including mammoth, rhinoceros and horse. In their tentative interpretation of the site, the authors consider as well the possibility of a hunting camp. Markkleeberg is dated to the early Saale glaciation (MIS 8) and around 250 ka to maximum 300 ka (Schäfer et al., 2004).

6. Conclusions

In a critical evaluation of the earliest Palaeolithic finds in Germany, Baales et al. (2000) evaluated all claims of evidence of human activities in Germany before 500–600,000 years as unsubstantiated. Since then, the situation has not changed. Back to 450,000 a, fossil remains and various archaeological sites yielded significant evidence with a strong influence on understanding of hominid behaviour. Archaeological evidence for the period between 450,000 and 700,000 a is more vague, and based on somewhat ambiguous data from Sarstedt, Kärlich and Miesenheim. Nevertheless, the oldest human fossil found so far, the mandible from Mauer, seems to belong into that time range. Prior to 700,000 a, evidence for a hominid presence in the region of Germany is very poor. All supposed stone tools reported are most likely the products of natural forces.

The poor presence of unquestionable lithic assemblages in the earliest stages of the Palaeolithic consequently lead several authors to the proposition of a bone or even wood industry as substitutes, not only for the German Lower Palaeolithic (Narr, 1966). Before the discovery of the Schöningen site, where well preserved wooden spears were found in context and associated with lithic artefacts, the absence of proof, however, mostly prevented these claims to be taken into serious consideration. Still, at Schöningen as well as other sites with a presence of indubitable wooden and bone tools, they are accompanied by lithic artefacts which in general seem to be necessary for the manufacturing of artefacts made of organic materials (Pawlik, 2004). A diverse appearance of the Lower Palaeolithic in Germany is obvious. However, good evidence for the earliest settlement is not established. The stratigraphic context and formation processes are often not clear and under heated debate. It is necessary to overcome obvious methodological problems in numerical dating and chronostratigraphic correlation of the Lower Palaeolithic sites, as well as in the characterization of their artefact assemblages.

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